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DISCUSSION OF SEDIMENTATION STUDIES AT CONCHAS RESERVOIR IN NEW MEXICO

(Published in August, 1950)

By T. Blench, and D. C. Bondurant

HYDRAULICS DIVISION

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DISCUSSION

T. BLENCH,[3] M. ASCE.—The useful information in this paper is appreciated, particularly the data in Table 5. It would be helpful if the author (in his closing statement) would show grading curves for the Lake Mead (Arizona-Nevada) sediment mentioned in the paragraph preceding the "Summary," for comparison with Fig. 3. Such curves should be for both lake water and for distilled water. The writer has some records of Lake Mead sediment from near the dam, and they show the material to be almost entirely of finer than silt size, unlike the material of Fig. 3.

The 68% dry weight cited in the second paragraph preceding the "Summary" seems physically possible only for a soil, and this anomaly needs further explanation.

D. C. BONDURANT,[4] ASSOC. M. ASCE.—Since preparation of the paper, the Conchas Reservoir on the South Canadian River in New Mexico has been resurveyed[5] and Table 6 is presented to include data from this survey. The total sediment accumulation as of February, 1949, was 35,600 acre-ft, with approximately 6,000 acre-ft (or 16.8% of the total) being deposited in the

TABLE 6.—CONCHAS RESERVOIR SEDIMENTATION SURVEYS

Date of Survey (Beginning January, 1939)	Period (years)	Period Inflow, in acre-feet[a]			Period Sediment Accumulation, in acre-feet		
		Total	Mean Annual	Maximum Annual	Total	Mean Annual	Per sq miles per yr[b]
May, 1940	1.4	114,300	81,600	....	1,400	1,000	0.144
June, 1942	2.1	1,369,800	652,300	936,400	14,600	6,950	1.000
November, 1942	0.4	457,300	....	....	4,000	....	....
October, 1944	1.9	235,600	124,000	....	4,400	2,290	0.330
February, 1949	4.3	528,600	122,900	154,700	11,200	2,610	0.376
Total	10.1	2,705,600	266,536		35,600	3,520	0.506

[a] Average annual flow computed for 44-yr period—213,400 acre-ft. [b] Sediment contributing area redetermined as 6950, sq miles.

Conchas arm. Inflow from the Conchas River has been 6.6% of the total reservoir inflow. The average annual inflow into the reservoir for the 10 years of operation to 1949 was 266,500 acre-ft, somewhat exceeding the estimated 44-yr average flow of 213,400 acre-ft at the dam site. The great

NOTE.—This paper by D. C. Bondurant was published in August, 1950, as *Proceedings—Separate No. 29*. The numbering of footnotes, equations, tables, and illustrations in this Separate is a continuation of the consecutive numbering used in the original paper.

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[5] "Second Interim Report on Sedimentation in Conchas Reservoir, South Canadian River Watershed," Corps of Engrs., U. S. Army, Albuquerque District, Albuquerque, N. Mex.

spread in the data shown in Table 6 emphasizes the need for long term records for investigations of flash-type streams.

The level of storage in the revervoir has continued to remain relatively constant, and the minimum elevation attained since the first filling was El. 4192.05, or 9 ft below the service spillway crest. The top and face of the deltas have maintained essentially the same slopes as those previously quoted, although an added range located on the face of the delta of the Canadian arm shows the slope at that point to be 22.3 ft per mile instead of 17.1 ft per mile as shown in Fig. 1.

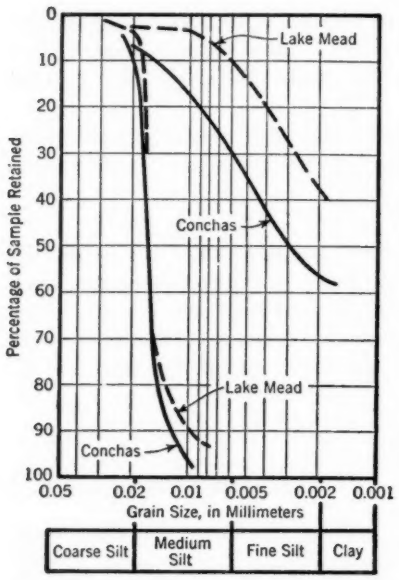

FIG. 4.—ANALYSIS OF SEDIMENT FROM CONCHAS RESERVOIR AND LAKE MEAD

Although the conduits in the dam are used only for flushing or for waste release, they have been operated at fairly frequent intervals for short periods. Samples of the conduit discharges indicate that approximately 230 acre-ft of sediment have been discharged since the survey of October, 1944. Most of this discharge has apparently occurred with density flows during minor flood inflows, as exemplified by the period from June 1 to June 4, 1948. On June 1 the mean daily inflow was 9,225 acre-ft, and sediment concentration in the release flow was less than 0.06% by weight. By June 3 the release flow contained 5.48% sediment that decreased to about 0.03% by the end of the fourth day. Total sediment discharge during this period was 94.8 acre-ft. In contrast to this discharge, normal waste or flushing releases may contain from 3% to 5% sediment immediately after the gates are opened but usually run clear within 15 min with the sediment discharge being on the order of 0.1 or 0.2 acre-ft.

Comparative analyses of material from Conchas Reservoir and Lake Mead, as requested by Mr. Blench, are shown in Fig. 4. Two sets of curves representing analyses made on separate fractions of single samples are included to illustrate the great spread of apparent particle sizes obtained by variations in the concentration of sediment and character of water used in the analyses. The analyses showing the finest particle sizes were made with sediment that had been continuously leached with distilled water for one week, although other tests indicated that the leaching had very little effect. These tests were made with distilled water, using the bottom withdrawal method at sediment concentrations in the tube of about 400 ppm. Altogether some 300 tests were made at varying concentrations in water from various sources, and about that many different results were obtained. As a result of these variations, an investigation of the activity of the clay minerals was initiated, and it is now

recognized that the difference between the disperse analyses of the Conchas and Lake Mead samples, as shown in Fig. 4, is far more important than was previously known. Most of this difference is in the proportion of material smaller than 0.002 mm where the flocculating properties of the clay minerals become important.

The factor of particle size is also believed to explain the anomaly of the high concentrations of sediment in samples from Rio Puerco, N. Mex., on which Mr. Blench requested more information. The concentration of 68% is the highest sampled in that stream within the author's knowledge, but samples containing 30% to 40% are quite common. Even at 68% concentration the stream possessed all the characteristics of fully developed turbulence with numerous intermittent sand waves and high velocities. The author does not have ready access now to analyses of material from Rio Puerco, but he recalls that it was very fine and that samples remained quite turbid for several days. The ability of colloidal clay minerals to be transported at very high concentrations results from electro-chemical properties possessed by these very fine particles. The implications of the properties of the clay minerals are too extensive to be discussed in the space here available, but there is evidence that they are the controlling factors in the flocculation of sediments, formation of density currents, nature of the deposits formed, and other phenomena.

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